# WEST Search History

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| | | *DB=USPT,EPAB,JPAB,DWPI,TDBD; PLUR=YES; OP=OR* | |
| ☐ | L10 | L9 and l8 | 9 |
| ☐ | L9 | (time near2 hop$3) | 2755 |
| ☐ | L8 | 370/316.ccls. or 370/320.ccls. or 370/321.ccls. | 742 |
| ☐ | L7 | L6 and 375/138.ccls. | 0 |
| ☐ | L6 | (inter$ near3 satellite$) and (short near3 (packet$ or pulse$)) | 74 |
| ☐ | L5 | (inter$ near3 satellite$) and (time near3 hop$3) | 21 |
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| ☐ | L2 | 375/138.ccls. or 375/130.ccls. | 880 |
| ☐ | L1 | 370/138.ccls. or 375/130.ccls. | 837 |

END OF SEARCH HISTORY

L5: Entry 4 of 21 File: USPT May 6, 2003

DOCUMENT-IDENTIFIER: US 6560450 B1
TITLE: Satellite communications routing and addressing method

Brief Summary Text (5):
Communications systems are now being developed in which the system nodes comprise a constellation of non-geostationary satellites, e.g. low earth orbit (LEO) satellites. These systems comprise a ground segment incorporating e.g. ground stations, gateways and user terminals, and a space segment comprising the satellite network in which each satellite functions as a switch or a router. It will be appreciated that the topology of such a system is constantly changing as the satellites move relative to the earth's surface and to each other. In a proposed system, a large number of satellite communications nodes are placed into circumpolar orbits, there being a number of satellites evenly distributed around each orbit so as to provide coverage of much or all of the global surface. Communication with the ground is effected via up-links and down-links to ground stations. Movement of the satellites relative to the ground stations is accommodated by appropriate hand-over procedures. A typical system of this type comprises two hundred and eighty eight satellites divided into twelve orbital planes for the initial phase, this phase being planned to cover 95% of the landmass. Further satellites may be added in the future. The system embodies inter-satellite links (ISL) not only for intra-plane and inter-plane node communications, but also at the cross-seam. Some of these ISLs can be turned on or off at appropriate times. The space segment of the satellite network results in a geodesic topology network that provides good tolerance to faults and congestion and has a symmetrical structure.

Brief Summary Text (7):
A particular problem in such a system is that of routing traffic between two ground based terminals via a succession of satellite nodes. It will be appreciated that, routing in a network that is changing topology rapidly because the satellite coverage is time varying, the inter-satellite links are dynamic. Depending on the satellite position, some of these links can be off or on, and some are always on. It will also be appreciated that, because the satellites are moving thus constantly changing the network topology in a complex manner, a routing table based routing would require continual updates. Moreover, an accurate routing would require every satellite to be well aware of the topological changes in the space segment. This could be done by storing all the information in the satellites, but this would be very costly since the topological changes are extremely complex even if there are in principle predictable and a large amount of information storage and processing would thus be required. Another way would be to require each satellite to send topological information to its neighbours (for example). This also would be very costly in terms of overheads due to the fast pace at which the topology is changing.

Brief Summary Text (9):
A discussion of satellite communications routing techniques is provided by Markus Werner et al, ATM-Based Routing in LEO/MEO Satellite Networks with Inter-satellite Links. IEEE Journal on Selected Areas in Communications, January 1997, and by Markus Werner, A Dynamic Routing Concept for ATM-Based Satellite Personal

Communication Networks. IEEE Journal on Selected Areas in Communications, October 1997.

Brief Summary Text (22):
According to another aspect of the invention there is provided a method of routing of packet communications traffic at a satellite node in a communications network comprising a constellation of non-geostationary satellites servicing a plurality of ground based cells via up-links and down-links, there being inter-satellite communications links between adjacent satellites, the method comprising providing a said packet with a destination address incorporating binary Gray codes corresponding to the destination cell of that packet, and, at a said node, comparing the Gray code address of that packet with address codes corresponding to the current position of the satellite so as to provide a simple determination of the direction in which that packet should be routed to an adjacent satellite over a said inter-satellite link.

Detailed Description Text (4):
In the system of FIG. 1, all the satellites have substantially identical characteristics in terms of capacity of the links and processing capabilities. Each satellite 11 behaves as an independent switch in the sky, connected to the earth or ground segment via the up-links 13 and down-links 14 (see FIG. 1a) and to adjacent satellites via the inter-satellite links (ISL) 15, 16. There are three kinds of ISL: intra-plane links 15, inter-plane links 16, and a variation of these latter that are referred to as cross-seam links.

Detailed Description Text (5):
In the network of FIGS. 1 and 1a, here are two intra-plane links 15 per satellite 11, one pointing forward and one backward to the adjacent satellites 11a and 11b in the same orbital plane 12. Both these intra-plane links are in service permanently. There are two further types of inter-satellite links, these being termed inter-plane and cross seam links respectively. As shown in FIG. 1a, the inter-plane links 16 are directed towards the neighbouring satellites in adjacent orbits at each side of the orbital plane 12; that is, for a constellation with near pole orbits, there would be two links 16c and 16d to neighbours 11c and 11d in the West direction and two links 16e and 16f to neighbours 11e and 11f in the East direction. Since the orbital planes suffer a small shift in time, these inter-plane ISLs require switching from one satellite to other from time to time. Usually this task is performed twice every orbit period. For example, in a network in which, the orbit period is about 2 hours, a specific inter-plane ISL would last for something less than one hour.

Detailed Description Text (6):
The most dynamic inter-satellite links (ISL) are the cross-seam links 16g. Due to the crossing between the edge orbit planes, at the cross-seams at the polar regions, the satellites are in those orbits are moving in opposite directions. This means that the switching between satellites will be much faster. For the exemplary two hundred and eighty eight satellite model referred to above, a cross-seam inter-satellite link would last typically for 4.5 min, depending on the configuration of the system, having to perform a hand-over to the incoming satellite after this period.

Detailed Description Text (27):
When a packet arrives at a satellite node, the destination address of the packet (represented in FIG. 11) is compared with the tables that have been stored in the node. Firstly, the first three bits of the destination address, corresponding to the destination sector are identified and compared. According to the result of this comparison, the satellite performs a specific task, which can be a sector routing or a comparison of the sub-sector bits. According to the result of this second comparison, the satellite performs either an inter sub-sector routing or a comparison of the cell bits. According to the result of this third comparison, the

satellite performs either a local routing or an intra-sub-sector routing. The result of a local routing is to send the packet on one of the downlinks of the satellite while all the other routings result in sending the packet on an ISL.

Detailed Description Text (60):
If we look at the mean number of hops in time in FIG. 5, we appreciate that the average number of extra hops is close to 0.8 and stable in time, which means that on average the packets are going to use 0.8 more hops than the shortest path. The additional delay introduced by this small number of extra hops is negligible.

CLAIMS:

1. A system wherein each satellite within a said group has permanent inter-satellite links with its immediate neighbours in that group.

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L5: Entry 7 of 21 File: USPT Apr 30, 2002

DOCUMENT-IDENTIFIER: US 6381053 B1
TITLE: Fast frequency hopping spread spectrum for code division multiple access communication networks (FFH-CDMA)

Brief Summary Text (17):
For local area networks with a bit rate on the order of Gigabits per second, optical frequency synthesizers with a chip hopping rate on the order of a tenth of a Gigabit per second are required for optical implementation of the FFH-CDMA technique. However, a practical optical frequency synthesizer has a very limited hopping rate. Slow frequency hopping CDMA (SFH, i.e. one frequency-hop per data bit); and very slow frequency hopping CDMA(one hop per packet of bits) have been previously proposed for optical inter-satellite CDMA communications. The bit rate was limited to a few tenths of Megabits/sec. Furthermore, for local area networks with a bit rate on the order of Gigabits per second, an optical frequency synthesizer with a chip hopping rate on the order of a tenth of Gigabits per second is required for optical implementation of the FFH-CDMA technique.

Other Reference Publication (18):
Wada, N., Sotobayashi, H., Kitayama, K.-Y. "Error-Free transmission of 2-Channel 2.5 Gbit/s Time-Spread/Wavelength-Hop OCDM using Fibre Bragg Grating with Supercontinuum Light Source," European conference on Optical communications, Nice, France, Sep. 1992, 2 pages.

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L5: Entry 21 of 21 File: USPT Feb 12, 1980

DOCUMENT-IDENTIFIER: US 4188578 A
TITLE: Satellite communication system which concurrently transmits a scanning spot beam and a plurality of fixed spot beams

Brief Summary Text (7):
Arrangements for using a movable beam in satellite, airborne, or mobile communication systems have also been disclosed. For example, U.S. Pat. No. 3,750,175 issued to R. M. Lockerd et al on July 31, 1973 discloses a modular electronics communication system comprising a plurality of radiating elements formed into an antenna array for transmitting and receiving communication frequency signals and employing a central processor to generate the transmitted signals and process the received frequencies through a manifold arrangement. Each radiating element connects to the manifold through a module made up of integrated microwave circuitry including a mixer coupled to a local oscillator and a phase shifter coupled to a beam steering computer. By means of the beam steering computer the antenna can be made to scan various preselected areas to primarily overcome tolerances in the satellite's or aircraft's attitude control system and maintain a beam at a desired target area. Additionally, the possible use of steerable beams and time-hopped steerable beams was suggested, but no implementation thereof shown, in Progress in Astronautics and Aeronautics, Vol. 33, pp. 503-531 at page 507 in the article "Characteristics and Applications of Multibeam Spacecraft Antennas", which was presented as Paper 72-530 at the AIAA 4th Communications Satellite Systems Conference, Washington, D.C., April 24-26, 1972.

CLAIMS:

10. The method according to claim 9

characterized in that

the method comprises the further steps of:

(g) in performing steps (e) and (f), subdividing each of the first predetermined intervals of time (t) into a plurality of q burst periods, each burst period comprising r bits of information representative of a separate one-way transmission channel for assignment between ground stations in two ground station areas interconnected during any instant of time via the satellite repeater interconnected up-link and down-link signals.

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L10: Entry 6 of 9 File: USPT Feb 5, 2002

DOCUMENT-IDENTIFIER: US 6345066 B1
TITLE: Reduction of access time delay in frequency-hopping radio systems using a direct sequence mode

Detailed Description Text (6):
However, reduction of the number of hop channels is allowed if the processing gain at the receive side can be obtained in some other way, for example by DS spreading. A combination of FH and DS spreading is allowed as long as the combined processing gain is at least 17 dB. Such a hybrid system spreads its power by first multiplying each bit with a high-rate chip spreading code, and then hopping from time to time to a new hop frequency. Since the number of hop channels is only an issue during startup (because after frequency hop synchronization has been established, the number of hop channels to spread over is immaterial), DS spreading is applied only during startup in order to permit a temporary reduction of the frequency hop spreading while still obtaining sufficient spreading gain to comply with the FCC rules. The reduced set of hop frequencies used during startup can be an arbitrary selection out of the 79 hops defined in FIG. 1. FIG. 3 is an illustration of one such arbitrary selection. In this example, it is desirable to remain compatible with the hop allocation according to the IEEE 802.11 definition for FH systems. However, this need not be a limitation in all cases. In fact, a completely different set of hop channels can be defined in the 2.4 GHz band as long as the FCC part 15 rules are fulfilled. This selection can, for example, be based on an identity of a user or a network. Alternatively, selection of a reduced set of hop frequencies for use during paging can be based on intelligently avoiding jammers. For example, since microwave ovens operate in the region from about 2440 to 2480 MHZ, it may be advantageous to select the reduced set of FH channels from the lower end of the 2.4 GHz band.

Detailed Description Text (12):
The operation of the paging procedure is further illustrated in FIGS. 6-8. The reader is also referred to the several applications, each entitled "Access Technique of Channel Hopping Communications System," mentioned and incorporated by reference above. A unit in standby mode wakes up after every time interval T_sleep and listens on a single hop frequency for a time duration designated T_scan. During each wake-up event, another hop frequency is selected from the reduced set of wake-up frequencies, as shown for example in FIG. 3. When the unit listens, all input signals are routed to the correlator 400 where the unit tries to match the input bit stream to the expected page message. If the correlator does not trigger during the scan period, the radio unit returns to sleep.

Current US Cross Reference Classification (1):
370/320

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